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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/561,536

Filing Date: December 19, 2005

Appellant(s): OISHI ET AL.

Nathaniel D. McQueen
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed April 16, 2009 appealing from the Office action mailed June 16, 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct.

The grounds of rejection of claims 1-5, 22, and 23 are incomplete. In addition to Thum & Lorenz, Housh et al., and Hawley's Condensed Chemical Dictionary, the rejection of the aforementioned claims also relies upon Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor).

The changes are as follows:

(1) Claims 1-5, and 22-23 stand rejected as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English Translation) in view of Housh et al. ("Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th Ed., revised by Richard Lewis, Sr.), with evidence from Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor).

The grounds of rejection of claim 21 are correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Thum, A. and H. Lorenz, "Tests on magnesium alloy threaded fasteners," Centre of Darmstadt College of Higher Education, Vol. 84, No. 26 (September 7, 1940), pp. 667-673, English translation thereof pp. 1-4.

Housh, S.; Mikucki, B.; Stevenson, A., "Selection and Application of Magnesium and Magnesium Alloys," Vol. 2 (2002), ASM Handbooks Online.

Hawley's Condensed Chemical Dictionary, 14th ed. (2002), revised by Richard J. Lewis, Sr.

Webster's New World Dictionary of American English, 3rd college edition (1988), Victoria Neufeldt, editor in chief, p. 157.

Higgins, Raymond A., *Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th ed. (1993), pp. 90-94.

Callister, Jr., William D., *Materials Science and Engineering, An Introduction*, 6th ed. (2003), pp. 174-175 and 180-184.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-5, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English translation thereof pp. 1-4) in view of Housh et al. ("Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th ed., revised by Richard Lewis, Sr.), and further in view of Higgins (Engineering Metallurgy, Part I: Applied Physical Metallurgy, 6th ed., pp. 90-94) and Callister, Jr. (*Materials Science & Engineering, An Introduction*, 6th ed.), with evidence from Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor).

Regarding claim 1, Thum & Lorenz report their findings on the mechanical properties of different magnesium-based threaded fasteners comprising bolts and nuts

(Thum & Lorenz, see threaded fasteners #1-6, p. 3-4). By definition, a bolt typically has a head portion and a threaded body like a screw (Webster's, p. 157, drawings in col. 2). The magnesium-based alloys have tensile strengths ranging from 24 kg/mm² to 35 kg/mm² (approximately 235 MPa to 343 MPa) (Thum & Lorenz, Table 1).

Still regarding claim 1, Thum & Lorenz fail to teach that the magnesium fasteners are made from drawn magnesium wire. However, Housh et al. teach that it is desirable to draw magnesium alloys because the drawing operation prevents the need to repeatedly anneal and redraw said alloy in subsequent processing steps, thereby decreasing the number of manufacturing steps required and lowering fabrication costs (p. 6, second paragraph). Furthermore, drawing is as a standard method for producing metal wires (Hawley's, "draw" entry). Therefore, it would have been obvious to one of ordinary skill in the art to form the bolts of Thum & Lorenz from the drawn wires of Housh and Hawley's because the drawing would eliminate additional processing steps, making the manufacturing process more cost-effective and efficient as explained above.

Still regarding claim 1, Thum & Lorenz in view of Housh et al. and Hawley's are silent as to the grain diameter of the magnesium alloy. However, grain diameter is a result of the degree of deformation imparted to any alloy, as taught by Higgins (Fig. 4.18, p. 94). Therefore, achieving the claimed grain size would require merely routine optimization of the drawing process by one of ordinary skill. It would have been obvious to one of ordinary skill in the art to draw the magnesium wire taught by Thum & Lorenz in view of Housh et al. and Hawley's such that the deformation imparted by the drawing operation of Housh et al. produces an alloy with a particular grain size, such as that not

exceeding 15 microns as claimed, in order to obtain a screw with specific set of desired mechanical properties. Furthermore, grain size is a result-effective variable, as taught by Callister, Jr., where the Hall-Petch relationship shows that the smaller the grain, the stronger the material (Equation 7.5, Figure 7.13, p. 175). Thus, it would have further been obvious to one of ordinary skill in the art to suppress the grain diameter to less than 15 microns as claimed because smaller-grained materials have enhanced mechanical properties. (MPEP § 2144.05 “Optimization of Ranges”)

Regarding claims 2 and 3, magnesium-based alloy Magnewin 3512 contains 3% Al, 1% Zn, and 0.2% - 0.5% Mn (Table 1). The Examiner will interpret the chemical compositions in the prior art to be percentages by weight.

Regarding claim 4, Thum & Lorenz teach a magnesium-based alloy threaded fastener containing Al, Zn, and Mn, but fail to teach a fastener containing Mg, Zn, Zr. However, Housh et al. teaches that the alloy designated ZE63A-T6 contains 5.8 wt% Zn, 0.7 wt% Zr, the balance Mg (p. 4). It would have been obvious to one of ordinary skill in the art to form ZE63A-T6 into a screw because of its outstanding physical and mechanical properties. ZE63A-T6 has a tensile strength of 300 MPa (Housh et al., p. 4) and is lightweight compared to its more dense counterparts such as aluminum, titanium, and iron. Lightweight components are particularly advantageous in vehicles in which weight is a critical factor (e.g., aerospace) as lighter parts contribute to the reduced fuel consumption (Thum & Lorenz, first paragraph; Housh et al., “Introduction,” first paragraph).

Regarding claim 5, the instant claim encompasses zero percent by mass of rare earth element. Because none of the magnesium-based alloys in Thum & Lorenz contain a rare earth element, any of the alloys would anticipate this composition limitation.

Regarding claims 22 and 23, the claims are product-by-process claims. It has been held that “even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process” *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

(10) Response to Argument

First, appellant argues that *Hawley's Condensed Chemical Dictionary*, *Webster's New World Dictionary*, and Higgins all teach techniques that are pertinent to general metalworking or general metallurgical engineering, but not to magnesium or magnesium alloys, and that because of their lack of relevance to magnesium or its alloys, the above references would not be applicable to Thum & Lorenz and Housh et al. In response, magnesium is a metal; thus, the aforementioned references relevant to general metalworking or general metallurgical engineering would be applicable to magnesium. Furthermore, nowhere in *Hawley's Condensed Chemical Dictionary*, *Webster's New World Dictionary*, and Higgins is it taught or implied that the techniques disclosed

therein cannot be used on magnesium and magnesium alloys. Additionally, the techniques disclosed in *Hawley's Condensed Chemical Dictionary*, *Webster's New World Dictionary*, and Higgins are actually implemented by Thum & Lorenz and Housh et al. The technique of drawing disclosed by *Hawley's Condensed Chemical Dictionary* is also disclosed in Housh et al. Housh et al. teach that drawing is one method of working magnesium and magnesium alloys ("Formability," para. 2, sentence 2; entire section under "Deep Drawing"). The fastening object known as a bolt, as defined in *Webster's New World Dictionary*, is also disclosed in Thum & Lorenz. Thum & Lorenz make bolts out of magnesium alloy (pp. 3-4). The technique of annealing alloys to relieve stresses disclosed by Higgins is also disclosed by Housh et al. Housh et al. teach that magnesium alloys that have been cold-drawn may be heated to 150°C to relieve stresses ("Deep Drawing," para. 2, sentence 2). Thus, the techniques in *Hawley's Condensed Chemical Dictionary*, *Webster's New World Dictionary*, and Higgins that are allegedly inapplicable to magnesium and its alloys appear to be applicable to magnesium and its alloys as demonstrated by the fact Thum & Lorenz and Housh et al. teach that those same techniques may be used on magnesium and its alloys.

Second, appellant argues that the conventional techniques of the prior art would not produce the claimed crystal grain diameter. Appellant's rationale is that the working temperatures disclosed by Housh et al. (allegedly greater than 250°C) would coarsen the grains and thereby not enable one of ordinary skill in the art to obtain grains with sizes within the claimed range. In response, Table 16 of Housh et al. ("Formability"

section) discloses temperatures below 250°C. For example, magnesium alloys AZ31B-H24, AZ80A-T5, and ZK60AT5 may be formed at 163°C, 193°C, and 204°C, respectively. It should be noted that these temperatures are below 250°C.

Third, appellant argues that none of the references disclose specifically decreasing the average crystal grain diameter to 10 microns or less, or suppressing the maximum crystal grain diameter to 15 microns or less. In response, varying processing parameters such as degree of deformation and temperature in order to achieve a desired grain size in metals is well known in the art, as evidenced by Higgins. Note that drawing is a type of deforming (forming) process (Housh et al., "Formability" and "Deep Drawing" sections). Higgins shows that grain size decreases as the degree of deformation increases (p. 94, para. (c), Fig. 4.18). Therefore, one of ordinary skill trying to obtain a particular grain size would merely need to optimize the degree of deformation to achieve the desired grain size. Since grains grow larger as the temperature increases (Higgins, p. 94, para. (a), Fig. 4.17; also Callister, Jr., p. 183, Fig. 7.20), it would furthermore be obvious to one of ordinary skill in the art to conduct the deformation at lower temperatures, rather than higher, to prevent grains growing (coarsening) to an undesirable size. It would furthermore be obvious for one to form relatively small grains, such as 10 microns or less or 15 microns or less, because smaller grains contribute to increased tensile strengths (Callister, Jr., p. 183, Fig. 7.20).

Fourth, appellant recites that the claimed grain size of the magnesium screw is formed by a specific drawing process disclosed in the specification of the present application and asserts that conventional techniques require heating magnesium wire to

greater than 250°C. In response, a review of Housh et al. shows otherwise. Housh et al. teach that magnesium wires can be drawn in a single draw and that depending on the alloy (e.g., AZ31B), the percent reduction can be as high as 68% ("Deep Drawing," para. 4, sentence 4). Note that this reduction is possible as the temperature approaches 230°C ("Deep Drawing," para. 4, sentence 3), which is below the temperature appellant asserts to be "conventional" in the art.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Vanessa Velasquez/

Examiner, Art Unit 1793

Conferees:

/Roy King/

Supervisory Patent Examiner, Art Unit 1793

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Supervisory Patent Examiner, Art Unit 1793

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